

SOLICITATION FOR LETTERS OF INTEREST (LOI) NO. RXL-4-44205**“THIN-FILM PHOTOVOLTAICS PARTNERSHIPS PROGRAM”****READ THIS DOCUMENT CAREFULLY**

This solicitation is being conducted under the streamlined procedures for competitive Letters of Interest established by the National Renewable Energy Laboratory (NREL). NREL will select a LOI for potential subcontract award based on the following:

- All requirements being met
- The best combination of: Technical Factors (based on qualitative merit criteria,) Evaluated Cost, and Additional Factors for Evaluation

Issue Date: 05/26/04 Due Date: 07/09/04 Time Due: 5:00 p.m. Mountain Time

Technical questions **must be received in writing** no later than **06/16/04** and can be faxed to Loretta Schmidt (303) 384-7326, or sent via e-mail to loretta_schmidt@nrel.gov

1. SOLICITATION TYPE: Best Value Letters of Interest

Submit LOI Responses to and Request Information from the NREL LOI Contact below:

2. NREL LOI CONTACT: National Renewable Energy Laboratory
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Electronic (PDF and Word) copies of forms and appendices can be found at:

http://www.nrel.gov/business_opportunities/related_docs.html



3. INTRODUCTION/BACKGROUND

The National Renewable Energy Laboratory (NREL) invites you to submit a Letter of Interest (LOI) response for a research and development project entitled “Thin-Film Photovoltaics Partnership Program” (TFPPP) in accordance with the requirements and conditions set forth herein. NREL is a national laboratory managed under a Department of Energy M&O contract with the Midwest Research Institute and operated under a teaming arrangement between MRI and Battelle Memorial Institute.

NREL plans to sustain support of thin-film R&D and to continue National R&D Team activities made up of academia, thin-film photovoltaic (PV) industry, NREL, the National Center for Photovoltaics (NCPV), and the Center of Excellence for Thin Film Photovoltaics at the Institute of Energy Conversion, University of Delaware, in the different thin-film PV technologies and for thin film module reliability. The purpose of the TFPPP is to accelerate the progress of thin film solar cells and module development as well as to address mid- and long-term research and development issues. The long-term objective of the TFPPP is to demonstrate commercial, low-cost, reproducible, high yield and robust photovoltaic (PV) modules of 15% aperture-area efficiency, about \$50/m² area cost, and thirty-year lifetimes. These goals are stated explicitly for thin films in the US DOE Solar Energy Technology Program’s “Multi-Year Technical Plan 2003-2007 and Beyond,” (<http://www.eere.energy.gov/solar/about.html>) Table 4.1.1-1 (page 50); and they are consistent with reaching the DOE long-term goal (2020) of cost-effective PV electricity at about 6 cents/kWh levelized energy cost. All responders should use the “Multi-Year Technical Plan 2003-2007 and Beyond” as a reference in developing their LOI.

The purpose of this program is to make progress toward this objective by achieving aggressive interim goals in thin film module efficiencies; cell and module processing; cell and module reliability; and in the technology base that supports these key areas. For more background information on the NCPV, see the following web site: <http://www.nrel.gov/solar/>.

Existing NREL-sponsored National R&D Teams will be restructured to support progress of Technology Partners after subcontract awards. All awardees must participate in National R&D Team activities, and an LOI response to this solicitation must indicate acceptance of this condition. As part of the new direction of the National R&D Teams, Technology and R&D Partners will be required to contribute in new ways:

- A. Technology Partners will be required to lead collaborators to address key company issues that support their progress; Technology Partners are expected to be as forthcoming as possible, sharing information for the purpose of enhancing understanding and advancing their technology.
- B. Research and Development Partners will submit within three (3) new categories, and will be required to include contributions to the progress of Technology Partners. This work may address both short-term issues that, if solved, can enhance the commercial viability of thin film PV modules, as well as longer-term issues improving the performance for future manufacturing schemes. Corporate and academic responders are expected to contribute to this requirement, and will further be required to perform and *publish* research for the common good of the technology, instead of holding such research business confidential.

These requirements will be part of the LOI response evaluation process, and responders are advised to emphasize how these requirements are addressed using cost-effective approaches.

Given this approach, NREL will act as an informal moderator of disputes among Team entities in order to respect each Technology and Research and Development Partner's needs in any National R&D Team activities. Lack of good-faith cooperation by awardees may lead to stoppage of work as a result of the annual review and funding approval process.

In recent years, the commercial success and market share of thin-film PV products has not shown as much progress as needed. The TFPFP believes that some reasons for this are lower than expected performance (module efficiencies), reliability issues, as well as market perception and marketing issues. It is also obvious that wafer-based crystalline Si PV has achieved significant economy-of-scale advantages, which raises the cost-, performance-, and initial manufacturing plant capacity goals to successfully introduce thin film PV technology into the commercial marketplace.

Compared to past programs, NREL will apply stricter cost and performance goals for thin-film PV technologies that are already commercialized or suggested for near-term commercialization by potential Technology Partners. (Approaches that require more time for development until they can be commercialized, or the development of next-generation technology by current commercial entities, will also be considered under this solicitation for R&D Partners, *but commercialization is not suggested or expected until performance and reliability has been demonstrated at the cell, sub-module and module levels.*) In order to be considered competitive for a Technology Partner award, a PV module technology, fabricated using low-cost commercial processes, should be >7% efficient today, with the potential to increase such efficiency to ~10% or greater as a result of further efforts.

The DOE/NREL/NCPV strategy in undertaking this initiative is to maintain the good coupling between laboratory results from fundamental materials and process research to manufacturing R&D, pilot-line operation, and commercialization of advanced thin-film PV products in the marketplace. The intent is to do this through cooperation with academia, U.S. thin film PV companies, and DOE laboratories within our National R&D Teams. The initiative supports other DOE/NCPV activities by accelerating the marketplace availability of potentially low-cost PV technologies.

This solicitation is structured around *four* (4) types of participants: **Technology Partners, Solar Cell Process Developers (Optimizers), Contributors to Directed Topics, and Specialized Contributors**. These latter three (3) categories will be collectively referred to as R&D Partners. LOI responses will be separately evaluated and ranked within the four distinct categories, and the budget amounts to be allocated to each category will be determined independently after assessing programmatic requirements. Budget allocations are expected to be given priority in the sequence listed, i.e., **Technology Partner** highest and **Specialized Contributors** lowest (although exact amounts will only be decided at the time of the awards).

The following Table 1 summarizes the emphasis and focus of the *four* (4) categories:

| TABLE 1 – LOI CATEGORIES | | |
|---|--|--|
| Category | Emphasis/Focus | Typical Output |
| Technology Partners | R&D and technology development concerning prototype/early commercialization modules and fabrication, environment, safety and health, process control, stability, and module packaging issues that will support the <i>near- and medium-term commercial viability of their product.</i> | Improved cells, sub modules, modules; improved processes (control, yield, cost); improved cell & module designs and reliability; higher volume production; reliable packaging; accelerated and outdoor reliability data |
| Solar Cell Process Developers (Optimizers) | Production of solar cells or prototype minimodules with champion or other noteworthy attributes. This work can focus on either or both near-term or longer-term performance goals compatible with TFPPP goals. | Improved cell and minimodule efficiencies; improved processes; improved cell stability; much thinner CIS and CdTe layers; enhanced understanding of key issues; journal and conference papers; effective collaborations. |
| Contributors to Directed Topics | This category includes certain defined topics (see below) considered important to the success of thin film PV. <i>These include assessing and addressing device and module reliability issues, module packaging, and deployment issues, with a goal of assuring better customer acceptance of thin film PV modules</i> | Success with specified topics; journal and conference papers; effective collaborations |
| Specialized Contributors | Special material deposition, characterization or modeling capabilities that are useful to advance thin-film solar cell performance. We now encourage crosscutting LOI responses that apply such capabilities to more than one thin film PV technology, where fruitful. | Understanding of key issues; journal and conference papers; effective collaborations |

For the purpose of this solicitation, thin films are defined as those based on the following light-absorbing semiconductor materials (and related alloys): amorphous silicon (a-Si), cadmium telluride (CdTe), copper indium diselenide (CIS), and film-silicon (film-Si) on low-cost substrates (silicon thickness <50 microns) used in consort with amorphous silicon in a multijunction device (no single-junction thin film crystalline silicon devices will be accepted). No other PV technology will be considered under this LOI. Also, no multijunction device structures (with the exception of

a-Si or a-Si/film-Si multijunctions) will be accepted (e.g., CdTe on CIS), as such combinations are part of the High Performance Photovoltaic Initiative.

LOI responses in the **Technology Partners** Category will be accepted in a-Si (or a-Si/nanocrystalline-Si), CdTe, and CIS technologies only, *with a requirement that the potential offeror have produced substantial commercial quantities ($\sim 1\text{MW}_{\text{peak}}$ or greater) in the preceding 12 months, with a typical commercial product efficiency of 7%, or greater, using the PV technology proposed.* It is expected that some combination of module optimization, process optimization, and reliability optimization will be the main thrust of this work.

Solar Cell Process Developers (Optimizers): The TFPPP recognizes the importance of evaluating new material and device schemes, cell stability, and progress towards new champion efficiencies in actual high-efficiency solar cell structures. Hence, responses in the **Solar Cell Process Developers (Optimizers)** category will be considered. NREL is looking for responders capable of producing cells with near state-of-the-art performance, or high efficiency cells with other desirable properties. Responders are expected to have already established baseline processes for >7% efficient a-Si single-junction cells, >9% demonstrated a-Si/a-Si or a-Si/nc-Si double junction cells, and >10% efficient triple-junction cells. For CdTe and CIS cell makers, an acceptable baseline process is defined as achieving >11% and >13%, respectively. Thirteen percent efficient CdTe-based cells and 15% efficient CIS-based cells are expected to be routinely produced by the responder later on in the program. Higher-efficiency starting levels will of course be considered more attractive during evaluation.

In the past, cell research was often driven by new deposition methods for the semiconductor layer. Because many of these approaches have not resulted in the anticipated cell efficiencies, NREL would like to see novel deposition approaches de-emphasized, unless very promising cell results can be quickly demonstrated with such deposition approaches. Instead, NREL would like to see more emphasis on new or modified device structures, use of new junction layers, some work on high efficiency cells with much thinner absorber thicknesses for CIS and CdTe cells (well below 1 micron, as thin as possible), light-trapping schemes for ultra-thin cells, and faster deposition or processing rates in instances where such rates are limiting cost-effective manufacturing. (In the case of developmental work like making new designs with ultra-thin absorbers, efficiency goals can be relaxed to more suitable levels.) All cell work shall include assessment of instabilities, and the requirements and goals stated above shall be considered stabilized, total-area cell performance values. Notoriously, setbacks were suffered in the past when laboratory cell processes were scaled up from small area R&D systems (substrate sizes $< 250\text{ cm}^2$) to commercial module sizes.

Directed Topics: To better understand the problems associated with scale-up, NREL will consider LOI responses investigating scale up issues going from R&D size systems to sub module sizes ($> 800\text{ cm}^2$) under this LOI category. Recent feedback from PV users and commercial decisions by industry suggest the need for a new category of LOI responses called **Directed Topics**. In this category, only responses that address tasks specifically listed in section 5 of the LOI will be accepted.

These specific tasks are geared to increasing awareness, understanding, and ultimately mitigating perceived or real problems with thin film PV module reliability; these activities will go beyond the traditional activities consisting of fabrication, characterization, and modeling of solar cells and solar cell materials and include module packaging and deployment issues.

In the final category, **Specialized Contributors**, responses are solicited to address specialized characterization methods, material preparation, solar cell device performance characterization and assessment, modeling, preparation of single layers useful for cells (such as transparent conductors, reflectors for optical enhancement, etc.). Also considered will be responses addressing characterization of deposition processes, and process diagnostic and control schemes. Because some activities are useful for more than one thin film (e.g., characterization, modeling, transparent conductors), NREL *encourages* that such responses address more than one PV technology where it can be fruitful. This may require interaction with more than one National Team, hence the responders are advised to focus or sequence their responses to avoid sub-critical efforts.

4. OBJECTIVES

The objectives of this LOI are as follows:

- A. To support the successful introduction of U.S. thin-film PV products by addressing key near-term technical R&D issues at U.S. business concerns committed to thin-film PV technology;
- B. To support advanced (mid- and longer-term) thin-film R&D needed by industry for future product competitiveness, including improving module performance, cost per watt produced, and reliability of thin-film PV technologies.
- C. To advance the understanding of the requirements needed to achieve better thin-film PV cell and module performance, greater reliability and market acceptance, and investigate materials systems and new devices that can improve the cost/performance ratio of future thin-film PV factories.

In other words, the goal is to improve the likelihood of success of this generation of potentially low-cost thin film PV technologies, while keeping the “technology pipeline” full for future improvements.

In particular, the objectives are to accelerate the progress on the following aspects of thin-films based on a-Si, CdTe, and CIS for module design: fabrication, solar conversion efficiency, size, cost, processing, and reliability, as well as ES&H issues. The fundamental understanding of these materials and devices in order to improve module performance and reliability, and to enhance the next generation of thin-film products, is also of interest. Some examples of key questions to be answered are: i) Can the Staebler-Wronski effect losses in a-Si materials and devices be further reduced to increase stabilized performance?, ii) What are the possible contact and junction degradation mechanisms in thin-film CdTe devices?, iii) Can CIS fabrication processes be improved in terms of cost and throughput?, iv) Can film-Si (less than 50 microns) be successful as a bottom cell alternative for amorphous silicon cell multijunctions?, v) Which factors determine the yield in first-time module manufacturing?, vi) What are the best strategies to increase manufacturing yield?, vii) Can we assure the intrinsic stability and long-term outdoor durability of thin film modules?, viii) Can ultra-thin cells of CIS and CdTe be made that retain high efficiency? ix) Can CdTe modules be made at high yield with higher currents using thinner CdS?

5. SCOPE OF INTEREST

Following are some of the technical issues that responses to the LOI should address:

Technology Partners shall emphasize those technical issues that improve module performance, module reliability, and low-cost, high-yield, manufacturing. For **Technology Partners**, examples of major issues include:

- A. Improved module performance through efficiency improvements.
- B. Improved module fabrication processes (including cost, process control, throughput, and yield issues.)
- C. Improved R&D base to support high-efficiency processing.
- D. Alternate low-cost encapsulation approaches to reduce unit module cost and improve reliability.
- E. In-situ process diagnostics and monitoring.
- F. ES&H enhancements and recycling approaches as are appropriate to the technology.
- G. Fundamental understanding and alleviation of degradation mechanisms in thin-film solar cells and modules.
- H. Corporate commitment to near-term, high-volume manufacturing capability, and to use the knowledge-base developed during this Partnership Program in future low-cost, thin-film power and specialty products.
- I. Module reliability and customer acceptance and satisfaction; Technology Partners should also address tasks listed below under the **Directed Topics** category.

Some significant set of these major issues shall be addressed in the LOI response in order to be considered competitive for a **Technology Partner** award.

Examples of longer-term R&D issues are as follows:

- A. Enhanced total-area thin-film solar cell efficiency and/or aperture-area sub module efficiency.
- B. Potentially lower-cost, higher-throughput, large-area processing without loss in module efficiency.
- C. Fundamental research relating to the understanding of materials, improved device design, and modeling.
- D. Innovative characterization and measurements tools.
- E. Understanding of key solar cell and material-level changes that result in loss in performance (including variabilities affecting variability and consistency in large-area manufacturing), and the need to optimize solar cells interactively, i.e., predict, rather than find out by trial-and-error re-optimization requirements, new optimum layers required when one layer of the cell is deliberately altered.
- F. Novel and improved solar cell device structures, such as the use of thinner CIS and CdTe absorbers to reduce In and Te use, respectively.

LOI responses for **Technology Partners** should include some of their research effort in longer-term R&D issues such as described above. These activities will be given priority for National R&D Team activities in cooperation with academic institutions and NREL. They will also represent an ongoing commitment to the development of improved thin-film technologies.

Solar Cell Process Developers (Optimizers) are expected to demonstrate improved device performance and easier and lower-cost fabrication processes. In order to be a strong candidate, **Solar Cell Process Developers (Optimizers)** are expected to have already established full solar cell fabrication capabilities, robust baseline processes, and a demonstrated track record of achieving near-state-of-the-art solar cell efficiencies or otherwise noteworthy cell results. Proposed work can address both novel material and device concepts as well as assist with modest but significant improvements in performance and yield of processes already used in manufacturing. Such research can take place on an R&D scale (device substrate sizes ($<250\text{ cm}^2$) or can investigate scale-up issues using sub module sizes ($>800\text{ cm}^2$). It is not required to develop a complete sub module in this category, but rather demonstrate uniform and high cell performance and high yield over an increasing substrate area. The demonstration of a completed sub module can be optionally proposed, and will be considered a significant accomplishment if successful. We recommend to entities that presently do not have module fabrication capabilities in-house to use lower-tier arrangements or contract facilities to prepare such sub module, rather than acquiring such capabilities solely for the purpose of fabricating such sub module for this program. NREL encourages responders to be realistic with proposed efficiency goals, as non-attainment of goals may be considered either lack of talent or poor judgment. Certain high-risk approaches to cell fabrication will be considered (e.g., ultra-thin absorber layers, well below 1 micron in thickness) where initially modest cell performance has to be expected (in other words, it will be acceptable to propose despite not yet achieving the state-of-the-art efficiencies stated above). The success of such approaches will be gauged by relative progress that has to be convincing that state-of-the-art performance will be eventually attainable. Rather than focusing on new methods of synthesizing the active semiconductor cell absorber layer, the TFPPP prefers optimization strategies that optimize cells around an established, robust semiconductor deposition process and optimize the processing of the overall device to achieve greater performance and lower manufacturing cost.

Examples of issues to be addressed by **Solar Cell Process Developers (Optimizers)** are as follows:

- A. Development of robust processing schemes for cells with high efficiency values.
- B. Novel device structures which are promising for and compatible with low-cost manufacturing.
- C. Elimination of limiting bottlenecks, such as reducing deposition and processing times, reducing layer thicknesses, substitution for rare or expensive elements, by demonstrating cells with little or no performance loss in comparison to state-of-the-art baseline processes.
- D. Champion cells using higher-risk novel material or processing approaches.
- E. Systematic series of high-performance solar cells to assist in understanding device limitations, support modeling efforts, evaluate resilience to stress, or testing promising device concepts developed or reported elsewhere.

LOI responses in the category **Contributors to Directed Topics** should address some module-reliability and module-acceptance issues. Because NREL believes that some reliability and customer-satisfaction issues have to be overcome before thin-film PV modules will gain widespread market acceptance, we ask for responses that address the following topics that hitherto have not been specifically called out by the TFPPP. Where appropriate, we encourage responders to work closely with those who may have existing capabilities that would allow for rapid progress in chosen topics. Within this category, NREL will accept responses that address one or more of the following topics:

A. Module Package Durability and Reliability

This topic asks for responses that address one or more of the following issues:

- 1) Development of module packages using novel schemes and materials. This could entail soft front or back sheets, new concept for edge seal in glass-to-glass laminates, encapsulation schemes using thin-film or thick film coatings, etc.
- 2) Assessment and modification of currently used materials and schemes for protecting the performance and reliability of thin-film PV modules. This could entail modification or replacement of existing materials (such as adding adhesion promoters or aging inhibitors to EVA, or replacing EVA with something cheaper), sealing of module edges and electrical connections, and edge deletion schemes.
- 3) Development of schemes that reduce glass breakage, e.g., due to wind-load, mounting schemes, or differential thermal heating and expansion, degradation/failure of flexible modules due to rolling or “flapping,” keeping in mind that some products may be larger in size in the future than they are today.
- 4) Development of low-cost deployment schemes with high-volume commercial potential such as BIPV or rooftop deployment. Work may be geared towards making such schemes perform better and become more reliable, or towards achieving better customer acceptance for such deployment schemes.

B. Development of Methods for Improved Module Performance and Reliability Assessment

This topic asks for responses that address one or more of the following issues:

- 1) Analyses of module failures such as work geared to identifying failure mechanisms, development of mitigation schemes for such failures, or development of accelerated tests to verify and minimize or eliminate a specific failure mode.
- 2) Stress experiments with solar cells if stress induced changes are determined to have their origin from within the cell structure rather than the encapsulation.

C. **Performance and Reliability Analyses of Deployed Thin-Film PV Products**

This topic asks for responses that address one or more of the following issues:

- 1) Monitoring the performance and reliability of deployed thin film arrays and modules, for the purpose of generating data that will assist in predicting the performance of such system over their life cycle.
- 2) Monitoring of systems and deployed modules with the goal of assessing parameters that are of importance to potential users, such as performance (energy production) at different temperatures, light levels, spectral conditions, deployment options, etc. Note that such studies are presently carried out at NREL. Responses are expected to generate new additional data.
- 3) Monitoring performance to detect system losses and failures that are the result of module failure mechanisms in order to feed back information for avoiding such failures, improving module packages, and eventually building a technology validation data base for thin film PV modules.

Note that in all cases, the heart of the contribution is expected to be insights into problems at the module level, not the system level. Every effort should be made to show how system level issues independent of module problems are removed from the analysis so that true module issues can be examined instead.

LOI responses in the **Specialized Contributors** category are expected to offer tasks on special material preparation research, specialized material and device characterization methods, analytical and numerical device modeling, and diagnostic schemes that can enhance reproducibility during manufacturing. Methods that characterize macro- to nano-non-uniformities in materials, solar cells, and PV modules are also of interest. Responders are cautioned that some logical, quantitative reasoning is expected, rather than qualitative statements such as (e.g.) "improved uniformity from the reduction of micro-voids" or "higher performance due to lower impurity concentrations." Strong LOI responses will provide numerical goals how material or measurement parameters can be quantitatively related to an improvement in cell or module performance or process yield. Strong LOI responses in this category will propose collaborative work, in most instances with other members of the National Teams, to establish such quantitative correlation between material and characterization parameters and cell and module performance or yield.

The descriptions of interests and possible activities listed under each LOI category are meant as example technical issues that could be addressed in LOI responses. It is encouraged that LOI responses include creative and logical approaches to justify and support their various tasks. LOI responses should provide a Statement of Work suitable to the organization's capabilities and priorities as they harmonize with the thin-film goals and objectives of the U.S. DOE Solar Energy Technologies Program Multi-Year Technical Plan and this LOI. The Multi-Year Plan may be viewed at: <http://www.eere.energy.gov/solar/about.html>.

It is expected that a significant portion of all work submitted under *any* category will be coordinated with National R&D Team activities. The complete demonstration of the viability of new approaches is expected to be carried out more and more as a team activity, including the development of material deposition and cell processes, scale-up issues, and module integration issues. In other words, while Technology Partners may focus on improving current methods

used for their manufacturing lines, keeping some process details proprietary and disclosing them only on a need-to-know basis, we expect that newer, "next generation" module technologies will be developed collaboratively within the team structure. In the past, sometimes specific technical approaches were encouraged or supported with the hope that such process would assure competitive commercial advantage. Such LOI responses are now discouraged, because they have generally not allowed those proposing them to achieve a discernable commercial competitive advantage. Immediate commercialization of new cell and module technologies is no longer expected; rather, new cell and module technologies are to be thoroughly demonstrated first at the appropriate material, cell, sub module or module levels before commercialization is attempted.

6. QUALIFICATION REQUIREMENTS

There will be a maximum of two (2) awards made under this solicitation to any one (1) organization; however, organizations can participate as lower-tier subcontractors under multiple awards. Also, entities may submit only one (1) response under the Technology Partner Category. Table 2 below summarizes the qualification requirements by category. (See also Table 4 below for information on the total estimated number of awards for each category.)

Note that in order to qualify as a Technology Partner, Section 3, above, specifies that such responders have already manufactured substantial amount of PV modules (1 MW_{peak} or greater in the prior 12 months) using the material technology of their respective LOI response. Minimum product efficiency should be greater than 7%, and the LOI response shall indicate how performance and manufacturing cost will be improved.

Responders under the Solar Cell Process Developers (Optimizers) category are expected to have established near state-of-the-art baseline cell processing for the material system proposed. The following efficiency values are considered minimums: 7% efficient diagnostic a-Si single-junction cells, 9% a-Si/a-Si or a-Si/nc-Si double junction cells, and 10% efficient triple-junction cells. For CdTe and CIS cells, these values are 11% and 13%, respectively. These performance levels shall be verified by NREL measurements. The LOI response should indicate how the proposed work will increase performance and manufacturability. LOI responses that address scale-up issues going from cells to sub modules and modules are also encouraged under this category, and expected to result in diagnostic cells with efficiencies routinely greater than the efficiency values specified.

For R&D Partners, it is required that they plan to publish at least one journal article per year on their research results, with the aim that this will demonstrate the most substantive aspects of their funded research.

NREL and Sandia National Laboratory (SNL), as the two (2) primary members of the National Center for Photovoltaics (NCPV), cannot participate on any LOI response. But NCPV thin film researchers shall participate on the National R&D Teams established as a result of this LOI.

The University Center of Excellence category is not re-competed at this point in time. The Institute of Energy Conversion (IEC), University of Delaware, currently holding a University Center of Excellence subcontract, cannot respond to this LOI. However, IEC may be included as a lower-tier subcontractor by other proposing entities.

After subcontracts are awarded under this LOI, it is NREL's intent that NCPV technical researchers will support the subcontracted efforts by performing activities, such as measurements and characterizations to validate performance of subcontract deliverables. However, neither NCPV technical researchers nor the NCPV program management shall make any direct or inferred commitment prior to subcontract award, either orally or in writing, to perform such support activities, or otherwise indicate that such support activities may subsequently become available through NCPV after the subcontract awards. LOI responses shall not contain any references to any possible future support activities to be performed by NCPV technical researchers. Responders should ensure that the proposed subcontract effort can be successfully completed and fairly evaluated independent of any proposed subsequent support activities performed by NCPV technical researchers. The LOI reviewers will include NREL, private sector, academia, foreign and government technical experts. Responders selected through the best value process (see Section 12 below) will be contacted to negotiate the technical requirements and final Statement of Work.

Research and initial manufacturing must occur in the United States (U.S.). Non-U.S. businesses and non-U.S. academic institutions are excluded from responding to this LOI. For purposes of this LOI, a U.S. business is defined as a business incorporated or formed as a legal entity in the United States.

Necessary qualifications and award eligibility are summarized in Table 2 below:

| TABLE 2 – QUALIFICATION INFORMATION BY CATEGORY | | |
|--|---|--|
| Category | Who is Eligible to Respond | Award Eligibility |
| Technology Partners | U.S. businesses can participate as responders or as lower-tier subcontractors. Academic institutions may participate as lower-tier subcontractors as part of company-led Technology Partners . | Maximum of one (1) award in this category per Responder to this LOI, plus one (1) additional award under one of the award categories listed below. Responders may also participate as lower-tier subcontractor for unlimited awards. |
| Solar Cell Process Developers (Optimizers) | U.S. business or academic institutions with established “near state-of-the-art” solar cell processing capability (lower-tier work may also be proposed under this category). | Maximum of two (2) awards per Responder to this LOI (regardless of category). Responders may participate as lower-tier subcontractor for unlimited awards. |
| Contributors to Directed Topics | U.S. business or academic institutions (as respondents or lower-tier subcontractors.) | Maximum of two (2) awards per Responder to this LOI (regardless of category). Responders may participate as lower-tier subcontractor for unlimited awards. |
| Specialized Contributors | U.S. business or academic institutions (as respondents or lower-tier subcontractors.) | Maximum of two (2) awards per Responder to this LOI (regardless of category). Responders may participate as lower-tier subcontractor for unlimited awards. |

Table 3 below shows the minimum cost share required:

| TABLE 3 - MINIMUM COST SHARE REQUIREMENTS | |
|---|---|
| Technology Partners | 50% for large businesses; 30% for small businesses*. |
| Solar Cell Process Developers (Optimizers) | 30% for large and 5% for small businesses*; no cost share required for academic institutions. |
| Contributors to Directed Topics | 20% for large and 0% for small businesses*; no cost share required for academic institutions. |
| Specialized Contributors | 20% for large and 5% for small businesses*; no cost share required for academic institutions. |

* See Section 16 for small business size standards.

Academic institutions are not required to cost share. Higher levels of cost share are welcome and will receive consideration during LOI response evaluation in accordance with Section 10 below. However, *in the case of lower-tier subcontracts with academic institutions proposed as part of **Technology Partner** LOI responses, the proposed amount for the lower-tiers can be subtracted from the total proposed amount before calculating minimum cost share requirements.*

No “in kind” cost share will be allowed. However, 100% of the cost of capital equipment can be used to satisfy cost share requirements. “In-kind” implies that a subcontractor already has the asset on hand, and it was not specifically or initially purchased for this project. Only costs incurred during the period of performance of a subcontract will be acceptable in meeting the cost share requirement, and the cost share cannot be funded by other Federal government sources. Higher levels of cost share are encouraged as appropriate, and will be given higher consideration during the evaluation process in accordance with Section 10 below.

Cost share means that a subcontractor or the lower-tier subcontractor shall share a set percentage of the total subcontract or lower-tier subcontract price.

Responders are notified that if they do not meet the minimum required cost share, the Responder, if selected for negotiations, would be afforded an opportunity to increase its cost share to meet the minimum requirements. If the Responder does not increase its cost share to comply with LOI requirements, the Responder’s LOI shall be removed from the competitive range. In addition, Responders will not be allowed to lower their proposed cost share percentages during negotiations since additional consideration is given for cost share greater than the minimum required cost share.

7. POTENTIAL SUBCONTRACT AWARD AND AVAILABLE PROJECT FUNDING

Funding for potential awards is based on availability of DOE funding and on programmatic considerations, as decided by DOE, NREL, and NCPV. All potential annual NREL/NCPV funding resulting from this competition from the TFPP will be limited, in accordance with the amounts set forth in Table 4 below, for any single subcontract.

NREL anticipates awarding **cost sharing and cost reimbursable type subcontracts**. (A sample of each type of subcontract is posted with this LOI.)

The estimated number of awards NREL intends to make is listed below in Table 4. However, these numbers will vary due to the LOI responses received, the programmatic emphasis at the time of the awards, and the availability of DOE and NREL/NCPV funds. The technological mix of these awards shall be based on NREL/NCPV needs to ensure technological continuity among the three options (a-Si/film-Si, CdTe, CIS). Depending on the number of technically competitive LOI responses in each technology, it is NREL's expectation that there will be at least one (1) and as many as *two* (2) **Technology Partners** awards per material option (a-Si, CdTe, CIS), unless no acceptable response is received from a qualified responder within a specific material area. Requirements to ensure technological robustness and continuity in the thin-film options are important elements of the programmatic considerations. In fact, NREL/NCPV reserves the right to make any number of awards or not to make any awards under this LOI document.

There are no NREL funds for the purchase of equipment for U.S. businesses available under this LOI. However, relevant equipment may be proposed as part of the U.S. business cost share. Funds for equipment may be made available to participating academic institutions, however it is NREL's intent to direct the majority of NREL funds toward the support of research and development activities rather than strengthening or adding research equipment and facilities.

The period of performance for awards is listed in Table 4 below. Annual reviews shall occur to evaluate the progress of the subcontract. These reviews will emphasize whether the subcontractor has met the requirements in relation to collaborations, National Teams, and published results. Technology Partners are expected to be responsive to leading National Team collaborations (including the Thin Film Module Reliability Team); and avoidance of any serious, un-addressed reliability problems with commercial modules sold during the contract. Phase funding shall be annually decided, depending on the reviews, and on the *availability of funding*. In the past, annual NREL budget fluctuations have caused some subcontract cancellations and this may recur. All subcontracts will be incrementally funded.

It is expected that the program funding available under this LOI will be approximately \$12 million from NREL/NCPV annually. The estimated breakout for individual awards per category is listed in Table 4 below.

Award information is summarized in Table 4 below:

| TABLE 4 - AWARD INFORMATION BY CATEGORY | | | |
|---|----------------------------|-----------------------|-------------------------------|
| Category | Estimated Number of Awards | Period of Performance | Annual NREL Funding per Award |



| | | | |
|---|---|--|--------------------------------|
| Technology Partners | Three (3) to five (5), with one (1) to two (2) per material option | Up to three (3) years, with one-year Phases. | Up to \$1.0 million |
| Solar Cell Process Developers (Optimizers) | Three (3) to eleven (11) with one (1) to five (5) per material option | Up to three (3) years, with one-year Phases. | From \$250,000 up to \$450,000 |
| Contributors to Directed Topics | Three (3) to six (6) | Up to three (3) years, with one-year Phases. | From \$30,000 up to \$200,000 |
| Specialized Contributors | Six (6) to twenty (20) | Up to three (3) years, with one-year Phases. | From \$30,000 up to \$200,000 |

8. COMPETITELY SOLICITED LETTERS OF INTEREST USING BEST VALUE SELECTION

This LOI shall be conducted utilizing Best Value Selection that results in the selection of LOI's for potential subcontract award that is most advantageous to NREL based on the **best value combination of (a) evaluated qualitative merit and (b) evaluated cost of the LOI's submitted.**

Best Value Selection is based on the premise that, if all LOI's are of approximately equal qualitative merit, award will be made to the Responder of the LOI(s) with the lowest evaluated cost. However, NREL will consider selecting an LOI with a higher evaluated cost if the LOI demonstrates the difference in cost is commensurate with the higher qualitative merit. Conversely, NREL will consider selecting an LOI with a lower evaluated qualitative merit if the cost differential between it and other LOI's warrant doing so.

9. QUALITATIVE MERIT CRITERIA FOR BEST VALUE SELECTION

The Scope of Interest (see Item 5) and the Qualification Requirements (see Item 6) in this solicitation serve as NREL's baseline requirements that must be met by each letter of interest.

The qualitative merit criteria (see Item 9) establish what NREL considers the technical factors valuable in an LOI. These qualitative merit criteria are performance-based and permit selection of the LOI's that provide higher qualitative merit for an increase in cost.

The following qualitative merit criteria will be used by evaluators to determine the technical value of the letter of interest in meeting the objectives of the solicitation.

Each qualitative merit criteria and its assigned weight are provided below: (note that qualitative merit B will be used only to evaluate the Technology Partner LOI responses):

A. Technical Quality and Relevance (44% for Technology Partners; 56% for R&D Partners)



- 1) The extent to which the proposed research addresses the technical issues listed in the SCOPE OF INTEREST, Section 5 above, and the potential of the proposed research to achieve the OBJECTIVES, Section 4 above, for the respective category - **Technology Partners, Solar Cell Process Developers (Optimizers), Contributors to Directed Topics, or Specialized Contributors**.
- 2) The extent to which the research approach has been developed and potential problems have been anticipated in the proposed research, as well as the explanation and soundness of the approaches to be pursued in the proposed research.
- 3) The extent to which the proposed research is appropriately phased, such that alternative approaches may be pursued or the work may be terminated early (usually at the end of either phase one (1) or two (2)) if the actual results obtained fall short of the research targets or milestones.
- 4) NREL expects each LOI response to propose ambitious, but achievable and realistic goals, within the context of their own resources and those to be provided by the subcontract. Unrealistically optimistic goals (based on a lack of supporting arguments) will be cause for greatly reduced consideration or elimination.

Note: All efficiencies referred to in this solicitation are based on the NREL standard measurement conditions (global AM1.5, 25⁰ C; total-area for cells; aperture-area for modules). Samples produced under resulting subcontract awards shall be delivered to NREL for verification. Use standard conditions to report accomplishments and to project achievable milestones. For a-Si devices, "initial" efficiencies will NOT be acceptable as either milestones or for measuring deliverables. NREL will accept a proposed minimal well-defined protocol for stressing devices to a stable range. LOI responses may include suggestions for such a protocol. Final protocol would be negotiated prior to subcontract award.

B. Commitment to Near-Term Commercialization (29% for Technology Partners; N/A for R&D Partners):

- 1) The extent to which the proposed effort has been demonstrated to accelerate and improve the likelihood of success of near-term thin-film manufacturing in the U.S. A critical part in the evaluation of this criterion is the Commercialization Strategy, Attachment 1 below. This Qualitative Merit Criteria B does not apply to the other categories of responses.

C. Capabilities (27% for Technology Partners; 44% for R&D Partners)

- 1) The availability, qualifications, and **past performance** of the proposed technical and management personnel (including any past work with the PV Thin Film Photovoltaics Partnership Program), as well as the resources, experience, and flexibility of the responder's organization(s).
- 2) A clear statement about the capability to collaborate with National Team contributors will be highly valued. This means that prior successes should be cited; and willingness and leadership for future collaborations should be highlighted. Given that much effort of the R&D Partners is expected to support the national technology base through the efforts of our national teams, it is in return expected that Technology Partners will devote greater focus to working with National Team collaborators in an

open and aggressive manner. Their intention to do so will be evaluated as part of this Qualitative Merit Criteria.

10. ADDITIONAL FACTORS FOR EVALUATION

In addition to the qualitative merit criteria above, each LOI will be evaluated against the following additional factors to determine the competitive range and final negotiation rank order. These factors are not weighted.

- A. The need to have a mix of Technology Partners, Solar Cell Process Developers (Optimizers), Contributors to Directed Topics, and Specialized Contributors in order to ensure technological continuity and to raise the likelihood of success for thin-film technologies as a whole; the need to adequately support thin-film material options deemed critical to the mid- and long- term success of the Program (CIS, CdTe, a-Si/film-Si); and the need to balance Thin Film Partnership funding among the best technological approaches, among performance and manufacturability issues and reliability and market acceptance issues, and between shorter-term and longer-term goals.
- B. The need to focus emphasis on the most promising technical approaches to meeting cost and performance goals. In order to have thin film PV modules successfully compete with crystalline silicon PV modules, module efficiencies should be greater than 7% now and show potential for substantial improvement towards the 10% - 15% commercial module goal (*or extreme potential for cost reduction*).
- C. The need to support the success of short-term commercialization within each of the three leading thin films (CIS, CdTe, a-Si).
- D. The need to have an appropriate level of National R&D Team participation and capabilities within the Partnership.
- E. The requirement that research and initial manufacturing occur in the United States.
- F. The requirement that only U.S. academia and businesses can respond to this LOI. For purposes of this LOI, a U.S. business is defined as a business incorporated or formed as a legal entity in the United States.
- G. The need to maximize competition and diversity of research by **limiting the number of awards and dollar value per organization** (per Section 7 above) and/or descoping major parts of the proposed tasks from successful LOI responses.
- H. Commitment to United States-based Commercialization in Case of Abandonment

Consistent with the provisions of the Federal Acquisition Regulations ("FAR") responders are given the opportunity to exploit subject inventions ("Subject Inventions") first created in the course of subcontract activities and may implement the results of such Subject Inventions into their commercial activities. If, however, an entity can no longer pursue

such commercialization or decides to abandon the Subject Inventions, the FAR sets forth the Government's rights in the promotion and commercialization of technology developed under Government funding.

11. COST EVALUATION FOR BEST VALUE SELECTION

After evaluation of the qualitative merit criteria and additional factors for evaluation, the following cost evaluation will be used to determine the best value of the LOI in meeting the objectives of the solicitation. Note that the combined qualitative merit value will be considered substantially more important than the cost.

- A. Reasonableness of the total estimated cost and the individual cost elements that comprise the total estimated cost.
- B. Responder's demonstrated understanding of the project based on the cost estimated to perform the work.
- C. Responder's demonstrated understanding of the risk involved based on the estimated cost proposed.
- D. Reasonableness of the estimated cost proposed in relation to the magnitude and significance of the work to be performed.
- E. Responder's level of cost sharing.

12. EVALUATION PROCESS

NREL will evaluate LOI's in two general steps:

Step One – Initial Evaluation

An initial evaluation will be performed to determine if all information has been provided for an acceptable LOI. Responders may be contacted only for clarification purposes during the initial evaluation. Responders shall be notified if their LOI is determined not acceptable and the reasons for rejection will be provided. Unacceptable LOI's will be excluded from further consideration. (For example, lack of commitment to National Team collaboration or the expected publication of research by R&D Partners will be grounds for elimination.)

Step Two –Discussion and Selection

All acceptable LOI's will be evaluated against the scope of interest and the qualification requirements; the qualitative merit criteria, the additional factors and cost evaluation listed above. Responders selected through the best value selection process will be contacted with the intent to negotiate the technical requirements of an acceptable Statement of Work, based on the

responder's LOI. Subsequently, NREL will issue a Request for Proposal (RFP) to confirm the technical requirements and finalize a cost proposal based on this developed Statement of Work.

13. LOI PREPARATION INFORMATION

- A. Subject to the award limitations in Section 6 above, if more than one LOI is submitted, each must be submitted separately and must clearly indicate the category: 1) Technology Partners, 2) Solar Cell Process Developers (Optimizers), 3) Contributors to Directed Topics, or 4) Specialized Contributors.
- B. Formatting instructions:
 - 1) A page is defined as one side of an 8 ½" x 11" sheet of paper.
 - 2) Use a 12-point font.
 - 3) Maintain at least 1-inch margins on all sides.
 - 4) Copies may be either single or double sided.
- C. Submit no more than the maximum number of pages as detailed under Items D and G, below.
- D. Submit a "**Letter of Interest**" in an original AND ten (10 copies) directed toward meeting the requirements of the solicitation. The LOI shall be organized in the following sections:
 - 1) A title page, to include the Request for LOI title and number, proposed project title, name of organization, and principal investigator (with postal address, telephone number, fax number, and e-mail address). The project title should be succinct and capture the essence of your LOI. The title page should also state which category the letter of interest is for: Technology Partners, Solar Cell Process Developers (Optimizers), Contributors to Directed Topics, and Specialized Contributors.
 - 2) A technical discussion limited to a maximum of fifteen (15) typed pages (single-spaced) supporting the proposed work. Elements to be addressed should include:
 - A one-page overview that indicates which technology the LOI response addresses and in what capacity, Technology Partners, Solar Cell Process Developers (Optimizers), Contributors to Directed Topics, or Specialized Contributors and that addresses how the LOI response satisfies the Qualitative Merit Criteria listed in Section 9 of this LOI solicitation. Also, this overview should include a statement that if awarded a subcontract; your organization agrees to participate in National R&D Team activities.
 - An outline of research approaches to be undertaken or concepts to be investigated and a timetable for reaching success or to abandon the research.
 - A technical discussion in support of research approaches.

-A discussion of potential technical difficulties and proposed solutions.

- 3) A concise Statement of Work, limited to five (5) pages, delineating the proposed tasks to be performed during each of the three years. This Statement of Work would form the basis for the Statement of Work in a potential subcontract.
 - 4) Statement of expected results, including a detailed breakdown of targeted milestones and deliverables (including publications of results) for each one-year Phase, and a proposed schedule for these by year, limited to two (2) pages.
 - 5) Description of facilities available to perform the proposed research. Facilities-related environment, health and safety issues must be addressed, if only to clarify existing strategies.
 - 6) A selected list and brief description of contracts or subcontracts related to the field covered by this LOI that the Responder has been awarded in the past five (5) years, to include the contracting agency's name, the contract or subcontract amount, a contact name and telephone number, and a brief description of the project. NREL may contact the contracting agencies.
 - 7) Abbreviated resumes (one page maximum) of one (1)-or two (2) key personnel. Key personnel must be excellent at leading the research at their organization and maximizing interactions and productivity with National Team research collaborators.
 - 8) For **Technology Partners** only: Submit a Commercialization Strategy, see Attachment 1 below, along with supporting discussion. This is limited to three (3) pages, and is not part of the final page number restriction of 30 pages (see below).
- E. Submit a completed **Estimated Budget Form** in an original and ten (10) copies. The Estimated Budget should include totals for each year (phase) and the total of all years. Profit or fee is not allowed for this solicitation. The estimated budget and delivery terms must be valid for 180 days from the date of the LOI response.
- F. In addition, LOI responses must include one (1) original (no copies necessary) of the following:
- 1) Completed "Representations and Certifications"
 - 2) Acknowledgments of all amendments to this solicitation. **Amendments will be posted on this web site – download/print the acknowledgment form for all amendments, sign, and enclose with the LOI response.**
- G. **The total LOI response, including any attachments or appendices, is limited to 30 pages (not counting the Commercialization Strategy, Representations and Certifications, Amendment Acknowledgments, and Estimated Budget Form).** Relevant references may be cited, but do not include copies of referenced articles in the submission. LOI responses may identify no more than ten (10) selected publications of

the principal investigator(s). **Note that all submissions are restricted to specified format.**

- H. This solicitation DOES NOT allow for the submittal of facsimile or electronic LOI responses.
- I. This solicitation does not commit NREL to pay costs incurred in the preparation and submission of a response to this request for LOI.

14. SOLICITATION PROVISIONS

A. Late submissions, modifications, and withdrawals of LOI's

LOI's, or modifications to them, received from qualified organizations after the latest date specified for receipt may be considered if received prior to selection, and NREL determines that there is a potential budget, technical, or other advantage, as compared to the other LOI's received. However, depending on the circumstances surrounding the late submission, NREL may consider a late LOI to be an indication of the respondent's performance capabilities, resulting in downgrading of the LOI by NREL evaluators in the technical evaluation process. A LOI may be withdrawn by written notice or telegram (including mailgram) received at any time before selection. A LOI may be withdrawn in person by a Responder or an authorized representative, if the representative's identity is made known and the representative signs a receipt for the LOI before selection.

B. Restrictions on disclosure and use of data

Responders, who include in their LOI's data that they do not want disclosed to the public for any purpose or used by the government or NREL, except for evaluation purposes, shall –

- 1) Mark the title page with the following legend:

"This LOI response includes data that shall not be disclosed outside the Government or NREL and shall not be duplicated, used, or disclosed--in whole or in part-- for any purpose other than to evaluate this LOI. If, however, a subcontract is awarded to this responder as a result of--or in connection with--the submission of this data, the government or NREL shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting subcontract. This restriction does not limit the government or NREL's right to use information contained in this data if obtained from another source without restriction. The data subject to this restriction are contained on pages *[insert page and line numbers or other identification of pages]*"; and

- 2) Mark each page of data it wishes to restrict with the following legend:

"Use or disclosure of data contained on this page is subject to the restriction on the title page of this LOI."

C. Intellectual Property Rights

Applicants and prospective applicants, in accordance with applicable statutes and the Department of Energy Acquisition Regulation (DEAR), have the right to request, in advance of or within 30 days after the effective date of award, a waiver of all or any part of the rights of the United States in subject inventions. Small business firms and domestic non-profit organizations normally will receive the Patent Rights clause of DEAR 952.227-11, which permits the recipient to retain title to subject inventions pursuant to 35 U.S.C. § 200 et. seq. Therefore, small business firms and non-profit organizations normally need not request a waiver.

For large businesses, the Government normally takes title to all inventions conceived or first actually reduced to practice under a DOE agreement. In this case, in view of the cost sharing and other equities of the recipients, at all tiers, DOE anticipates issuing a class waiver that waives title to such inventions to the recipients, subject to the Government's usual license, march-in, and U.S. preference provisions comparable to 35 USC 202, 203 and 204. Additionally, DOE's class patent waiver will include a U.S. competitiveness provision reflecting the programmatic objectives of the program, i.e., improving the competitive position as well as the U.S. employment opportunities in U.S. industries.

The Government has unlimited rights in technical data created under the agreement. Delivery or licensing of technical data developed solely at private expense will not normally be required except as specifically negotiated in a particular agreement or as may be negotiated as a condition of a patent waiver to insure continued development toward commercialization of an invention arising under a DOE agreement.

In the event a participant, other than participants having the right to elect to retain title to inventions pursuant to 35 U.S.C. § 200 et. seq., does not participate in subsequent phases of this project the remaining participants shall retain as a minimum a royalty-free, nonexclusive license throughout the world, with the right to grant sublicenses in each subject invention held by such participant pursuant to the class waiver, except as otherwise approved by DOE Patent Counsel.

D. Disclaimer

NEITHER THE UNITED STATES, NOR THE DEPARTMENT OF ENERGY, NOR MIDWEST RESEARCH INSTITUTE, NATIONAL RENEWABLE ENERGY LABORATORY DIVISION, NOR ANY OF THEIR CONTRACTORS, SUBCONTRACTORS, OR THEIR EMPLOYEES MAKE ANY WARRANTY, EXPRESSED OR IMPLIED, OR ASSUME ANY LEGAL LIABILITY OR RESPONSIBILITY FOR THE ACCURACY, COMPLETENESS, OR USEFULNESS FOR ANY PURPOSE OF ANY OF THE TECHNICAL INFORMATION OR DATA ATTACHED OR OTHERWISE PROVIDED HEREIN AS REFERENCE MATERIAL.

E. Solicitation Disputes

The General Accounting Office and the Department of Energy do not accept or rule on protests for solicitations for Letters of Interest issued by Management and Operating Contractors for the Department of Energy (operators of Department of Energy National Laboratories). Should a

responder have any concerns regarding the NREL solicitation process or selection determination, the responder may contact Marty Noland, Advocate for Commercial Practices at (303) 384-7550. NREL will address each concern received from a responder on an individual basis.

15. SOLICITATION PROVISIONS – incorporated by reference – general access

This solicitation incorporates one or more solicitation provisions by reference with the same force and effect as if they were given in full text. The following documents can be downloaded from the NREL general access website at:

http://www.nrel.gov/business_opportunities/related_docs.html

- A. NREL Representations and Certifications for Subcontracts
- B. NREL Estimated Budget Form

16. NAICS CODE AND SMALL BUSINESS SIZE STANDARD

- A. The North American Industry Classification System (NAICS) code(s) [formerly standard industrial classification (SIC)] for this solicitation is 54171.
- B. The small business size standard for 54171 is 500 or less employees.

Attachment 1 Commercialization Strategy

Instructions

A proprietary Commercialization Strategy must be included in the LOI response for competition in the **Technology Partners** category. It should be a well-considered, good faith projection of the responder's strategy for commercializing thin-films. It must be marked in accordance with Item 14 B, **Restrictions on disclosure and use of data**, above. Due to its confidential nature, it will be included in any final subcontract by reference only. The Commercialization Strategy will be a critical item used to judge the potential value of the LOI response in the **Technology Partners** category. We seek aggressive, but realistic plans that demonstrate the size and credibility of the Responder's commitment to translating technical progress into future products. The strategy should be written to include plans and critical issues concerning: scale-up, first-time manufacturing, product design, product introduction, reliability, and marketing plans, ES&H, and financial risks and requirements. Other aspects may be addressed as appropriate.

For those responders who have had prior Technology Partner awards, an exact copy of the most recent, prior "Commercialization Strategy" must also be included in this submission. In addition, a critique of this Commercialization Strategy must also be included, pointing out achievements and any alterations of the prior plans (and why). "Lessons learned" should be included. Once again, vigorous effort should be expended to be realistic about prior and current projections and shortfalls.

The page limit of the entire LOI (30 pages) does not apply to this item.